L. L. NARAYANA* and Digamber RAO**: **Contributions to the floral anatomy of Linaceae (14)*****

L. L. ナラヤナ*・D. ラオ** アマ科の花部解剖学的研究 (14)***

Introduction In the present communication the comparative floral morphology of Linaceae is discussed in the light of the information so far available on the floral anatomy of its members namely, *Indorouchera* (*Roucheria*) *griffithiana*, *Hebepetalum humirifolia*, *Ochthocosomus africanus*, *Ixonanthes icosandra* (Narayana and Rao, 1966); *I. beccari*, *I. crassifolia*, *I. grandiflora*, *I. petiolaris* and *I. reticulata* (Narayana and Rao, 1978c), *Anisadenia saxatilis* (Narayana and Rao, 1969b); *Ctenolophon parvifolius* and *C. philippinensis* (Narayana and Rao, 1971), *Philbornea magnifolia* (Narayana and Rao, 1973c), *Sarcotheca glauca*, *S. oblongifolia* (Narayana and Rao, 1974a), *Lepidobotrys staudtii* (Narayana and Rao, 1974b); *Linum flavum*, *L. lewisii*, *L. perenne*, *L. usitatissimum* (Narayana and Rao, 1976c); *L. grandiflorum*, *L. rubrum*, *Reinwardtia trigyna*, *Durandea pentagyna*, *Hugonia mystax* (Narayana, 1964), *Cathartolinum aristatum* (Narayana and Rao, 1976d), *Hesperolinon alatum*, *H. micranthum* (Narayana and Rao, 1977a), *Nezera cathartica* (Narayana and Rao, 1977b); *Hugonia planchoni* (Narayana and Rao, 1977c); *Indorouchera rhamnifolia* (Narayana and Rao, 1978a); and *Radiola linoides* (Narayana and Rao, 1978b).

Discussion The flower in Linaceae is basically pentacyclic, pentamerous, regular and hypogynous. In *Radiola linoides* (Narayana and Rao, 1978b), it is tetramerous and tetracyclic; in *Ochthocosmus africanus* (Narayana and Rao, 1966) though it is pentamerous, a tetracyclic condition is met with due to loss of the inner staminal whorl. Connation, adnation and reduction of floral parts and their traces are noticed in the different species of the family. While in *Ixonanthes icosandra* (Narayana and Rao, 1966) there is an amplification in the androecium, a tendency towards perigyny is noticed in

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*** Continued from Journ. Jap. Bot. **53**: 213-218 (1978).

the genus (Narayana and Rao, 1966, 1978c).

In *Sarcotheca glauca* (Narayana and Rao, 1974a) the main stele in the pedicel is associated with bands of sclerenchyma. The presence of sclerenchyma, either in the form of a continuous sheath or separate bands in *Sarcotheca glauca* (Narayana and Rao, 1974a), *Cathartolinum aristatum* (Narayana and Rao, 1976d), *Hesperolinon alatum* (Narayana and Rao, 1977a), *Hugonia planchoni* (Narayana and Rao, 1977c), *Ixonanthes crassifolia* (Narayana and Rao, 1978c) and *Radiola linoides* (Narayana and Rao, 1978b), resembles the condition noticed in the stems and petioles of Oxalidaceae and Geraniaceae (Metcalfe and Chalk, 1950). According to them (p. 303), in Oxalidaceae: "The basic vascular structure of the stem and petiole in both of them consists of a ring of separate collateral bundles frequently associated with a characteristic and well developed sclerenchymatous ring in the pericyclic region". The pedicel in *Indorouchera* (*Roucheria*) *griffithiana* (Narayana and Rao, 1966) and *I. rhamnifolia* (Narayana and Rao, 1978a) is covered by whorls of bracts and a bract of the topmost whorl is adnate to the innermost sepal. The presence of bracts on the pedicel in these species supports the commonly accepted view that the sepals are derived from bracts. Eames (1961), while discussing the nature and development of perianth in Angiosperms stated that the perianth has originated from bract-like protective organs. The flowers of Ranales and Dilleniales show all stages of evolutionary development of calyx from bracts. It is interesting to note that bracts in *Indorouchera* receive a single trace.

Five sepals showing quincuncial aestivation are noticed in all the investigated species of the family. However, in *Radiola linoides* (Narayana and Rao, 1978c) there are four valvate sepals. A tendency for synsepaly is noticed in *Anisadenia saxatilis* (Narayana and Rao, 1969b), *Cathartolinum aristatum* (Narayana and Rao, 1976d), *Ctenolophon parvifolius*, *C. philippinensis* (Narayana and Rao, 1971), *Hesperolinon micranthum* (Narayana and Rao, 1977a) *Hugonia planchoni* (Narayana and Rao, 1977c), *Ixonanthes* species (Narayana and Rao, 1966, 1978c), *Linum lewisii* (Narayana and Rao, 1976c), *Ochthocosmus africanus* (Narayana and Rao, 1966) and *Radiola linoides* (Narayana and Rao, 1978b). In their unequal size, the sepals in members of Linaceae, except in *Radiola linoides* (Narayana and Rao, 1978b), resemble Humiriaceae (Narayana and Rao, 1969a, 1973a, 1973b, 1976a, 1976b). *Anisadenia saxatilis* (Narayana and Rao, 1969b) differs from all the investigated species of Linaceae in the possession of stalked glands along the both margins of the two larger sepals and the outer margin of the intermediate sepal. Multicellular glands such as those reported in *Samadera indica* (Nair and Joseph, 1957) a member of Simaroubaceae occur on the abaxial side of the sepals in *Hugonia planchoni* (Narayana and Rao, 1977c). The presence of sclerenchymatous bands overlying the vascular bundles in the sepals of *Hugonia planchoni* (Narayana and Rao, 1977c), *Hesperolinon alatum* (Narayana and Rao, 1977a), *Indorouchera griffithiana* (Narayana and Rao, 1966), *Ixonanthes crassifolia* (Narayana and Rao, 1978c), *Nezera cathartica* (Narayana and Rao, 1977b), *Philbornea magnifolia* (Narayana and Rao, 1973c) and *Radiola linoides* (Narayana and Rao, 1978b) resembles a similar condition in the leaves of Linaceae (Metcalfe and Chalk, 1950). While the hairs and glands arise on the outer epidermis of sepals, they are absent on the inner epidermis. However, in the six species of *Ixonathes* studied (Narayana and Rao, 1966, 1978c), the cells of the inner epidermis of the sepals are palisade like with dense cytoplasm and prominent nuclei. In others like *Cathartolinum aristatum* (Narayana and Rao, 1976d) and *Hesperolinon alatum* (Narayana and Rao 1977a) they become radially elongated and sclerenchymatous.

The sepals are three-traced and thus resemble the leaves which also are three-traced (Metcalfe and Chalk, 1950). The origin of sepal traces at different levels in *Hugonia plachoni* (Narayana and Rao, 1977c) and *Philbornea magnifolia* (Narayana and Rao, 1973c) shows that the whorled arrangement of sepals in other species of the family is derived from ancestral spiral arrangement. In the absence of connation in the sepal traces, *Lepidobotrys staudtii* (Narayana and Rao, 1974a) and *Linum usitatissimum* (Narayana and Rao, 1976c) stand apart from other species of the family. Connation between laterals of adjacent sepals, or, between the laterals and midribs of the same sepal, occurs in the species with gamosepalous and polysepalous calyx. Thus, in this family also, gamosepaly is preceded by union of sepal traces. Formation of loops by the union of lateral traces of adjacent sepals such as reported in *Hopea rocophloea* (Nagaraja Rao, 1962), a member of Dipterocarpaceae, is seen in *Reinwardtia trigyna* (Narayana, 1964), *Hebepetalum humirifolia* and *Ochthocosmus africanus* (Narayana and Rao, 1966). Adnation between common sepal lateral traces and petal midribs is present in *Cathar-*

tolinum aristatum (Narayana and Rao, 1976d), *Ctenolophon philippinensis* (Narayana and Rao, 1971) *Hesperolinon alatum* (Narayana and Rao, 1977a), *Ixonanthes beccari*, *I. crassifolia*, *I. petiolaris* (Narayana and Rao, 1978c) and *Linum perenne* (Narayana and Rao, 1976c).

The petals are free and show contorted aestivation in all the species studied except in species of *Ixonanthes* (Narayana and Rao, 1966, 1978c) and *Lepidobotrys staudtii* (Narayana and Rao, 1974) where they are imbricate. In herbaceous species like *Cathartolinum aristatum* (Narayana and Rao, 1976d) *Hesperolinon alatum*, *H. micranthum* (Narayana and Rao, 1977a), *Nezera cathartica* (Narayana and Rao, 1977b) and *Radiola linoides* (Narayana and Rao, 1978b) there is basal adnation between petals and stamens resulting in a tube. The prominent, non-vascularised appendages which occur on the inner side of the petals along the midline in *Cathartolinum aristatum* (Narayana and Rao, 1976d) and *Hesperolinon micranthum* (Narayana and Rao, 1977a) resemble those in *Nectaropetalum kaessneri* (Rao, 1965) a member of Erythroxylaceae.

The petals are single traced and adnation between petal midribs and conjoint sepal laterals is seen in *Cathartolinum aristatum* (Narayana and Rao, 1976d), *Ctenolophon philippinesis* (Narayana and Rao, 1971), *Hesperolinon alatum* (Narayana and Rao, 1977a), *Ixonanthes beccari*, *I. crassifolia*, *I. petiolaris* (Narayana and Rao, 1978c) and *Linum perenne* (Narayana and Rao, 1976c), while in the remaining species they are not adnate (Narayana and Rao, 1966, 1969b, 1971, 1973c, 1974a, 1976c, 1977a, 1977b, 1977c, 1978a, 1978b).

The stamens are ten or five in number, united at the base to form a tube; when ten, they are invariably of two heights, the antipetalous being shorter. There is a strong tendency towards the suppression of the antipetalous whorls of stamens. The short antipetalous stamens seem to represent the first stage towards the reduction of this whorl. The next step in reduction is seen in *Anisadenia saxatilis* (Narayana and Rao, 1969b), *Cathartolinum aristatum* (Narayana and Rao, 1976d), *Hesperolinon alatum* (Narayana and Rao, 1976e), *Linum flavum*, *L. lewisii*, *L. perenne*, *L. usitatissimum* (Narayana and Rao, 1976c), *Nezera cathartica* (Narayana and Rao, 1977b), *Linum grandiflorum*, *L. rubrum* and *Reinwardtia trigyna* (Narayana, 1964) where they are reduced to filiform staminodes. The vascular supply to this antipetalous staminal whorl is completely suppressed though the organs are represented by staminodes. These instances do not support the doctrine of conservatism of the vascular bundles. The next condition is found in *Hesperolinon micranthum* (Narayana and Rao, 1977a), *Ochthocosmus africanus* (Narayana and Rao, 1966) and *Radiola linoides* (Narayana and Rao, 1978b) where the antipetalous whorl of stamens as well as their traces are completely suppressed. The haplostemonous condition in these three species, thus appears to have been derived from a condition where there are ten stamens of two heights. A similar tendency for reduction of the antipetalous staminal whorl is noticed in the families of Geraniales, like Oxalidaceae (Narayana, 1966) Meliaceae (Narayana, 1958, 1969) and also in *Erodium* (Saunders, 1937) where the antipetalous staminodes are without the vascular supply.

There is duplication of the antipetalous staminal whorl in *Ixonanthes icosandra* (Narayana and Rao, 1966) in which five belong to the antisepalous whorl and ten to the antipetalous whorl. Duplication by splitting of the antipetalous stamens has also been reported in *Monsonia* and *Sarcocaulon* of Geraniaceae and *Hypseocharis* of Oxalidaceae by Saunders (1937). Puri (1951) refers to this phenomenon as “dedoublement”. According to him it is brought about by the splitting of the stamens of a particular whorl. Dedoublement of stamens is also reported in other families like Amaryllidaceae (Arber, 1937), Cucurbitaceae, Fumariaceae (ct. Puri, 1951) and Polygonaceae (Eichler, 1875-78; Gross, 1913; Laubengayer, 1937).

The stamens are single traced and traces arise independently except in *Hebepetalum humirifolia* (Narayana and Rao, 1966), *Hesperolinon alatum* (Narayana and Rao, 1977a), *Ixonanthes grandiflora* (Narayana and Rao, 1978c), *Linum flavum*, *L. usitatissimum* (Narayana and Rao, 1976c) and *L. grandiflorum* and *L. rubrum* (Narayana, 1964) where there is adnation between the staminal traces and common median laterals.

There are three main types of variation in the origin of staminal traces in the species investigated. The first type is the origin of staminal traces in alternate whorls, antisepalous followed by antipetalous, as in *Ctenolophon parvifolius*, *C. philippinensis* (Narayana and Rao, 1971), *Hebepetalum humirifolia* (Narayana and Rao, 1966), *Hugonia planchoni* (Narayana and Rao, 1977c) and *H. mystax* (Narayana, 1964). In the second type all the staminal traces arise at the same level as in *Indorouchera griffithiana* (Narayana and Rao, 1966), *I. rhamnifolia* (Narayana and Rao, 1978c), *Ixonanthes icosandra* (Narayana and Rao, 1966), *I. petiolaris* (Narayana and Rao, 1978c), *Lepidobotrys staudtii*

(Narayana and Rao, 1974b), *Philbornea magnifolia* (Narayana and Rao, 1973c) and *Sarcotheca glauca* (Narayana and Rao, 1974a). This condition is brought about by the condensation of the internode between the two whorls of stamens. The third type is seen in *Ixonanthes beccari*, *I. crassifolia*, *I. grandiflora*, *I. reticulata* (Narayana and Rao, 1978c), *Sarcotheca oblongifolia* (Narayana and Rao, 1974a) and *Durandea pentagyna* (Narayana, 1964) where the traces for the antipetalous whorl of stamens are demarcated earlier than the antisepalous whorl of stamens, the androecium is thus obdiplostemonous. Saunders (1937) described the androecium in Linaceae as diplostemonous. But our studies show that diplostemonous, obdiplostemonous and haplostemonous conditions are present in the various members of the family.

Obdiplostemony is a characteristic feature of the families of Geraniales. Besides, it is also present in Malvales (Venkata Rao, 1952), Caryophyllaceae (Thomson, 1942), Crassulaceae (Subramnayam, 1955; Quimby, 1939; Tillson, 1940) and Diapensiaceae (Palser, 1963). When the androecium is obdiplostemonous, the normal sequence of origin of the traces is disturbed. Antipetalous position of the carpels is generally associated with this feature except when the number of carpels is less than number of stamens in each whorl. According to Saunders (1925), obdiplostemony is brought about due to displacement of the antipetalous stamens by the 'ballooning' of the carpellary locules. Dawson (1936) does not accept this explanation for certain Geraniaceae. In certain cases the petal midribs and the antipetalous staminal traces arise conjointly. Thus, they stand farther from the centre than the antisepalous staminal traces. According to Arber (1939) the petals and stamens opposite to them "form a unit in whorl alternation without being a unit in the morphological sense". This view explains the antipetalous position of the carpels in a satisfactory way. In *Geranium maculatum* according to Dawson (1936) there is the presence of a third whorl of vestigeal staminal traces along the sepal radii. With the suppression of the first whorl of stamens the second whorl is left opposite the petals. Here also the antipetalous position of the carpels can be satisfactorily explained.

In the species of Linaceae investigated, there was neither adnation between the petal and antipetalous staminal bundles nor any evidence of a third staminal whorl. The androecium in *Ctenolophon parvifolius*, *C. philippinensis* (Narayana and Rao, 1971), *Hebepetalum humirifolia* (Narayana and

Rao, 1966) *Hugonia planchoni* (Narayana and Rao, 1977c) and *Hugonia mystax* (Narayana, 1964) is diplostemonous as the antisepalous staminal traces arise earlier. In others they arise at one level due to condensation of the internode between the staminal whorls. The next step is the early divergence of the antipetalous staminal traces. This appears to be due to the tendency towards adnation between the petal and antipetalous staminal bundles. The obdiplostemonous condition of the androecium in Linaceae, thus, seems to have been the result of condensation of internode between the two normally alternating staminal whorls followed by a tendency towards adnation of the traces along the same radii. The antipetalous position of the carpels, at least in this family, does not seem to have any relation to the obdiplostemonous condition. The situation in *Schistostemon dichotomum*, belonging to Humiriaceae (Narayana and Rao, 1976b) also supports this view on the origin of obdiplostemony. In some species of Erythroxylaceae (Narayana, 1960; Rao, 1965) the traces of the two staminal whorls arise at one level this being due to telescoping of the internode between the two staminal whorls. In *E. mooni* (Narayana, 1960) the androecium is obdiplostemonous but there is no adnation between the petal midribs and the antipetalous staminal traces. In *Erythroxylum areolatum*, *E. brevipes*, *E. emarginatum*, *E. lanceum*, *E. ovalifolium*, *E. tortuosum*, *Nectaropetalum kaessneri* (Rao, 1965) and *E. coca* (Narayana, 1960) the petal midribs and the antipetalous staminal bundles arise conjointly. Unlike Humiriaceae and most species of Linaceae, the ovary in Erythroxylaceae is 3-carpellary, syncarpous and 3-locular. Thus, there is no relation between the position of carpels and obdiplostemony in Erythroxylaceae.

The position and morphology of the disc in the flowers of Linaceae is interesting. It is intrastaminal in the six species of *Ixonanthes* (Narayana and Rao, 1966; 1978c), *Lepidobotrys staudtii* (Narayana and Rao, 1974b) and *Ochthocosmus africanus* (Narayana and Rao, 1966), extrastaminal in *Ctenolophon parvifolius*, *C. philippinensis* (Narayana and Rao, 1971) and *Philbornea magnifolia* (Narayana and Rao, 1973c) and in the rest of the species studied (Narayana and Rao, 1966, 1969b, 1974a, 1976c, 1976d, 1977a, 1977b, 1977c, 1978a, 1978b) it is absent. Vascularization of the disc in *Ctenolophon parvifolius* (Narayana and Rao, 1971), *Ixonanthes beccari*, *I. crassifolia*, *I. grandiflora*, *I. petiolaris*, and *I. reticulata* (Narayana and Rao, 1978c) by the branches of staminal traces, shows that it is staminal in nature as in Humiriaceae

(Narayana and Rao, 1969a, 1973a, 1973b, 1976a, 1976b, 1976d; Rao and Narayana, 1965). Evidences from our studies indicate that the disc in Linaceae represents the inner or outer sterilized part of the staminal tube depending upon its position. A disc is present in other families of Geraniales, like Meliaceae (Narayana, 1958a, b; 1959b), Zygophyllaceae (Nair and Nathawat, 1958), Simaroubaceae (Nair and Jain, 1956; Nair and Joseph, 1957; Nair and Joshi, 1958; Narayana and Sayeeduddin, 1958) and Rutaceae (Tillson and Bamford, 1938; Moore, 1936). The disc has been interpreted as staminal in some members of Simaroubaceae (Nair and Jain 1956; Nair and Joshi, 1958).

The ovary is primarily 5-carpellary, syncarpous, 5-locular or 10-locular due to the development of a false septum which recedes from the centre towards the top. The carpels are usually syncarpous but in *Sarcotheca glauca* and *S. oblongifolia* (Narayana and Rao, 1974a) lateral connation between them is absent. A reduction in the number of carpels is noticed in the different species of the family. When the carpel number is five the position of the loculi may be antisepalous as in *Hebepetalum humirifolium* (Narayana and Rao, 1966), *Hugonia planchoni* (Narayana and Rao, 1977c), *Ixonanthes icosandra* (Narayana and Rao, 1966) and *Hugonia mystax* (Narayana, 1964) or antipetalous as in the remaining species investigated by us (Narayana and Rao, 1966, 1969b, 1974a, 1976c, 1976d, 1977a, 1977b, 1977c, 1978a, 1978b). Irrespective of the difference in number of carpels, two pendeulous, juxtaposed, anatropous ovules in each locule is a constant feature throughout the family. *Sarcotheca glauca* and *S. oblongifolia* (Narayana and Rao, 1974a) differ from all the investigated species of Linaceae in having two superposed ovules in each loculus recalling the condition in Oxalidaceae, where the ovules are arranged in linear rows (Knuth, 1931).

Both three traced and five traced carpels occur in the family. The traces supplying the carpels arise independently in all the species. However, in *Ixonanthes beccari*, *I. reticulata* (Narayana and Rao, 1978c), *Linum lewisii*, *L. perenne* (Narayana and Rao, 1976c), *Nezera cathartica* (Narayana and Rao, 1977b) and *Radiola linoides* (Narayana and Rao, 1978b) there is connation between median laterals of adjacent carpels. The common median laterals arise conjointly with the common ventral bundles in *Ixonanthes icosandra* (Narayana and Rao, 1966), *I. crassifolia* and *I. petiolaris* (Narayana and Rao, 1978c). There is adnation between common median lateral traces and antipetalous staminal traces in *Hebepetalum humirifolium* (Narayana and Rao, 1966) and between common median laterals and antisepalous staminal traces in *Hesperolinon alatum* (Narayana and Rao, 1977a), *Ixonanthes grandiflora* (Narayana and Rao, 1978c), *Linum flavum*, *L. usitatissimum* (Narayana and Rao, 1976c), *L. grandiflorum* and *L. rubrum* (Narayana, 1964). Judging from the position of the ventral bundles the placentation in *Hebepetalum humirifolium* (Narayana and Rao, 1966), *Hugonia planchoni* (Narayana and Rao, 1977c), *Indorouchera griffithiana* (Narayana and Rao, 1966), *I. rhamnifolia* (Narayana and Rao, 1978a) and *Philbornea magnifolia* (Narayana and Rao, 1973c) is axile as also reported in *Durandea pentagyna* and *Hugonia mystax* (Narayana, 1964). In the remaining species of this family the placentation is anatomically parietal (Narayana and Rao, 1966, 1969b, 1971, 1974a, 1974b, 1976c, 1976d, 1977a, 1977b, 1778b, 1978c). In *Ctenolophon parivifolius* (Narayana and Rao, 1971), there is no organization of ventral bundles as such. The ovule traces are derived directly from the central ring of vascular tissue formed after the demarcation of dorsal carpellary traces. A small portion of this tissue is left over after the ovular supply. A residual stele was observed in *Hugonia planchoni* (Narayana and Rao, 1977c). The presence of residual stele supports the concept that the floral organs are lateral.

In all the species of the family except *Ctenolophon parvifolius*, *C. philippinensis* (Narayana and Rao, 1971), *Hesperolinon alatum* (Narayana and Rao, 1977a), *Ixonanthes beccari*, *I. crassifolia*, *I. grandiflora*, *I. petiolaris*, *I. recticulata* (Narayana and Rao, 1978c), *I. icosandra* (Narayana and Rao, 1966), *Lepidobotrys staudtii* (Narayana and Rao, 1974b) and *Ochthocosmus africanus* (Narayana and Rao, 1966), the styles are free. The stylar supply is by the dorsal carpellary bundles except in *Ixonanthes* species (Narayana and Rao, 1966, 1978c) and *Sarcotheca* species (Narayana and Rao, 1974a) where they are traversed by the ventral bundles. In *Sarcotheca* species (Narayana and Rao, 1974a) the dorsal carpellary traces fade away in the receptacular cortex while in *Ixonanthes* species (Narayana and Rao, 1966, 1978c) they terminate at the base of the style. Where the style is common it shows a stylar canal lined by transmitting tissue.

Acknowledgements We are highly grateful to all those who have kindly sent the materials for the studies made in the family Linaceae. Our sincere thanks are due to Dr. K. Subramanyam for his valuable suggestions. Thanks are also due to Prof. U.B.S. Swami for his interest.

Summary A discussion on the floral anatomy of Linaceae on the basis of earlier publications by the authors has been put forward. The flower is basically pentacyclic and pentamerous, but in *Ochthocosmus africanus* it is pentamerous and tetracyclic, and tetramerous in *Radiola linoides.* Tendencies towards perigyny (*Ixonanthes* spp.). Connation, adnation and reduction of floral parts and their traces are noticed in the different species of the family. The five quincuncial sepals are three traced. Connation of sepal traces either between the midribs and laterals of the same sepal or between the laterals of adjacent sepals, is noticed in the different species of the family. However, in *Lepidobotrys staudtii* and *Linum usitatissimum* the midribs and laterals arise independently from a single gap. In *Durandea* species, *Hugonia plachoni* and *Philbornea magnifolia* the traces to the different sepals arise at successive levels indicating their spiral arrangement in the ancestral forms. Adnation between common sepal laterals and petal traces is noticed in species like *Cathartolinum aristatum*, *Ctenolophon philippinensis*, *Hesperolinon alatum*, *Ixonanthes beccari*, *I. crassifolia*, *I. petiolaris* and *Linum perenne.* The free, contorted petals are single traced in all the species. In *Cathartolinum aristatum*, *Hesperolinon alatum*, and *H. micranthum*, non-vascularised appendages are present on the inner side of the petals. The petals in the above species and in *Nazera cathartica* and *Radiola linoides* are united with the staminal tube at the base. The petal traces arise, either independently or adnate with the common sepal laterals. The androecium basically consists of ten stamens. Rarely as in *Ixonanthes icosandra*, there are fifteen stamens. Tendency towards suppression of antipetalous whorl of stamens is noticed in the family. In the species where the disc is present the stamens are adnate either to the outer margin or inner margin of the disc. In the remaining species the disc is absent and the stamens are monadelphous at the base. The disc is interpreted as staminal in nature. Diplostemony, obdiplostemony and haplostemony occur in different members of the family. The ovary is 2-5 carpellary. The carpels are three or five traced. The placentation is axile in *Durandea* species, *Hebepetalum humirifolia*, *Hugonia planchoni*, *Indorouchera griffithiana*, *I. rhamnifolia* and *Philbornea magnifolia* and anatomically parietal in the rest. In *Ctenolophon parvifolius* distinct ventral bundles were not observed. The styles are free,

partially or completely connate, and are lined by a transmitting tissue. They are usually traversed by dorsal carpellary bundles except in *Ixonanthes* species and *Sarcotheca* species where they are traversed by the ventral bundles.

The similarities and differences noticed in the floral morphology of Linaceae, Humiriaceae and Erythroxylaceae are discussed at the appropriate places.

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アマ科の花の構造は基本的には5数性であり5輪であるが，小数のものは5数性で4輪または4数性で4輪のものが見られる。一般には子房上位であるが，少数に子房

周位の傾向が見られた。また種類によって花の各器官の維管束に接着，沿着または退化などを起しているのが見られる。*Lepidobotrys staudtii* と *Linum usitatissimum* では1つの葉隙から各々独立の3本の維管束が萼片に入るが，多くのものは側脈は隣りの萼片の側脈と合着している。また1部のものは側脈は花弁の維管束と合着している。*Radiola linoides* では1つの葉隙から1本の維管束がでて中脈と側脈とに分れる。*Durandea* spp., *Hugonia planchoni*, *Philbornea magnifolia* では萼片に入る維管束は異る段階で中央維管束から分岐してきて，らせん配列の傾向を示している。花弁は各々1本の維管束が入る。

Cathartolinum aristatum, *Hesperolinon alatum*, *H. micranthum* では花弁の内側に維管束をもたない付着体がある。これらの種類と *Nazera cathartica*, *Radiola linoides* では花弁は基部で雄蕊筒と合着している。花弁の維管束は各々独立しているか萼片の側脈と沿着している。雄しべは基本的には10本であるが，*Ixonanthes* では15本である。花弁と対をなす雄しべには退化の傾向が認められる。雄しべの配列には diplostemonous, obdiplostemonous, haplostemonous のものが見られた。花盤がある種類では雄しべは花盤の内側か外側に付着している。花盤は雄しべ的な性質のものから由来したと思われる。子房は2～5枚の心皮からなり，各心皮には3～5本の維管束が走る。胎座は多くのものは解剖学的には側膜胎座であるが，一部のものには中軸胎座が見られる。*Ctenolophon parvifolius* にははっきりした腹行維管束は見られない。花柱は離生するものから完全に合着するものまであり，一般には背行維管束が入っているが，*Ixonanthes* と *Sarcotheca* の種類では腹行維管束が入る。

○シソクサについて（山崎　敬）Takasi YAMAZAKI: On *Limnophila aromatica* (Lam.) Merr. and *L. chinensis* (Osb.) Merr.

シソクサ属は Philcox 氏のモノグラフ（1969）でよくまとめられていて，大筋は明らかにされたが，細かな点になるとまだ色々と問題がある。シソクサもその一である。

シソクサ *L. aromatica* (Lam.) Merr. はインドからニューギニアにまで広がり，東アジアの熱帯から暖帯に広く分布している種類である。ところがインドシナ半島では北部に見られるだけで，一般には分布していないようである。そのかわりここには *L. chinensis* (Osb.) Merr. が普通に見らるれ。*L. aromatica* と *L. chiensis* とはごく近縁のもので，葉や花の形は全く異らない。ただ前者は茎やがくが無毛か柄のない腺毛が散生するのに対し，後者は茎やがくに長軟毛が散生または密生している点が異る。然し両者が分布しいるベトナム北部には中間形が見られ，標本の中には全体殆んど無毛で腺点か散在するが，よく見ると茎やがくに長軟毛が生えている個体(Hanoi, Pételot, no. 5524, no. 5525, P., Ninh Binh, Bon, no. 739. P. 等）がある。長軟毛の多少も個体により様々で，多いものは問題なく *L. chinensis* になるが，少ないも